Claims

1. Method for pre-emphasis of an optical wavelength division multiplex signal, of which the signals with different wavelengths assembled in groups (B1, B2, B3, B4) are transmitted over express channels as well as over drop channels, add channels or add-drop-channels of a transmission link (LWL) with a number of sections and network elements (WE) such as injection points, drop points (OADM) and termination points,
with the express channels being transmitted from a first network element (NE1) to a second network element (NE2) while drop channels add channels or add-drop channels are also injected at drop points (OADM) arranged between the first and second network element, characterized in that,
in a network element for termination of at least one group (B1) of signals an their injection point (NE, OADM) an average and an individual-channel power setting of the signals this group is undertaken, so that prespecified signal-to-noise ratios(OSNR1) are obtained, whereas for the non-terminated groups (B2, B3, B4) of signals the average power is set art a preceding network element (NE, OADM).

2. Method in accordance with claim 1,
characterized in that
at the injection point the average signal power of a group with drop channels or add-drop-channels dropped or terminated at a subsequent drop point is reduced in favor of the average signal power of an onwards-routed group of express channels.

3. Method in accordance with claim 1 or 2,
characterized in that
the redistribution of the average signal powers between the groups (B1, B2, B3, B4) in injecting or switching network

elements (NE) is undertaken with a signal power regulation.

4. Method in accordance with one of the previous claims.
characterized in that
the average signal-to-noise ratios (OSNR1, OSNR2, OSNR3, OSNR4) or differences between the signal-to-noise ratios of the different groups (B2, B3, B4, B4) of signals at their termination points are predetermined by a network management system.

5. Method in accordance with one of the previous claims 1 to 4,
characterized in that
to determine the power modifications to be made, the initial hypothesis is that all channels at the corresponding point can be changed individually and the average power modification of the channel group is then calculated from this specification.

6. Method in accordance with one of the previous claims.
characterized in that
for control of one of the sub-pre-emphasis settings a network element (NEi, OADMj) is activated with the aid of a data packet which is transmitted outwards and backwards from the first injection point (NE0) to the other network element (NEi, OADMj) section-by -section and which contains a marking (X) of the injection and termination points of each of the groups (B1, B2, B3, B4) of signals.

7. Method in accordance with claim 6,
characterized in that
at a network element (NEi, OADMj) the data packet is used for control of one of the additional individual-channel pre-emphases of one of the groups (B1, B2, B3, B4) of signals.

8. Method in accordance with claim 6 or 7,

characterized in that
for control of the direction of transmission and the range of the data packet between the network elements (NEi, OADMj) a counter (COUNT) is initialized, incremented or decremented in the data packet.

9. Method in accordance with one of the previous claims.
characterized in that
depending on the type of encoding of the counter (COUNT) and of a marking (X) for dropping a group (B1, B2, B3, B4) a regulation protocol provided at a selected controlling network element for control of pre-emphasis steps with sub-pre-emphasis settings and/or the additional individual-channel pre-emphasis of the groups (B1, B2, B3, B4) along the transmission link (LWL) is selected.

10. Method in accordance with claim 9,
characterized in that
on receipt of a data packet for which the counter (COUNT) has the value "0", a network element (NE1, OADM1, OADM2...) assumes control of the pre-emphasis steps for its subsequent network sections and that in this case the counter (COUNT) is incremented to the value -1.

11. Method in accordance with claim 9 or 10,
characterized in that
on receipt of a data packet for which the counter (COUNT) has the value "1"qt a network element (NE1, OADM1, OADM2...), a spectrum of the signals as well as the data packet from the next network element (OADM1, OADM2, NE2) are sent back along the transmission link (LWL) and that on the backwards journey of the data packet through each network element (NE2, OADM2, OADM1) without termination point, for all groups of channels there the counter (COUNT) is increased by the value 1,

otherwise remaining unchanged.

12. Method in accordance with claim 11,
characterized in that
for an unchanged counter (COUNT) the data packet is transmitted in an opposite direction.

13. Method in accordance with one of the claims 10 to 12,
characterized in that
at one of the network elements (OADM1, OADM2, NE2) with a termination of at least one of the groups of channels, a marking (X) is activated in the transmitted data packet for this (these) group(s) and
the marking (X) for a group is deleted at the injection point of the same group on return of the data packet.

14. Method in accordance with one of the claims 10 to 13,
characterized in that
on receipt of a data packet of which the counter (COUNT) has a higher value than 1 at a network element (NE1, OADM1, OADM2...) the counter (COUNT) of the data packet transmitted forwards - i.e. in the direction from the first network element (NE1) to the second network element (NE2) - is reduced by 1 if in this case at least one group of channels is not terminated, i.e. is let through or is injected.

15. Method in accordance with one of the claims 10 to 14,
characterized in that
on receipt of a data packet of which the counter (COUNT) has a higher value than 1 at a network element (NE1, OADM1, OADM2...) the counter (COUNT) of the data packet transmitted backwards - i.e. in the direction from the second network element (NE2) to the first network element (NE1) - is increased by 1 and
on arrival of the data packet transmitted in the backwards

direction the counter (COUNT) remains unchanged at the first controlling network element (NE1).

16. Method in accordance with one of the claims 10 to 15, characterized in that
on arrival of the data packet transmitted backwards at the first controlling network element (NE1) with a counter (COUNT), for which the value is equal to the value at the same network element (NE1) with the previous forwards transmission of the data packet, the counter is set to the value 0,
that the data packet is transmitted forwards to the next network element (OADM2),
the counter (COUNT) is incremented by the value 1 and thus the next network element (NE2) is defined as the new controlling network element for control of further pre-emphasis steps.

17. Method in accordance with one of the claims 10 to 16, characterized in that
pre-emphasis steps are undertaken at the controlling network element at a group of channels for which a marking (X) is activated there.

18. Method in accordance with claim 9, characterized in that
the pre-emphasis steps are controlled at different selected controlling network elements during the transmission of the data packet within the transmission link (LWL).

19. Method in accordance with claim 18, characterized in that
a network element which receives a data packet with a counter (COUNT) with the value "1" in an uplink direction UL, returns values of the power spectrum for an unchanged counter to the beginning of the transmission link (LWL) and marks groups of channels which are terminated at this network element.

20. Method in accordance with claim 18 or 19,
characterized in that
a network element which receives a data packet with a value of the counter (COUNT) greater than "1" in the uplink direction UL,
decreases the counter (COUNT) by the value "1" and passes on the data packet to the next network element.

21. Method in accordance with one of the claims 18 to 20,
characterized in that
a network element which receives a data packet in the backwards direction, increases the counter (COUNT) by the value "1" and passes the data packet on to the preceding network element.

22. Method in accordance with claim 21,
characterized in that
for all marked groups of channels which are inserted at the network element, an individual-channel pre-emphasis is executed and their corresponding markings are deleted.

23. Method in accordance with one of the claims 18 to 22,
characterized in that
for all non-marked groups of channels or groups of channels not inserted at the network element an equalization of the average power is undertaken if the counter (COUNT) has the value 1.

24. Method in accordance with one of the claims 19 to 23,
characterized in that
if the value of the counter (COUNT) is not "1", an individual-channel pre-emphasis for groups of channels marked and inserted at the network is performed.

25. Method in accordance with claim 24,

characterized in that
the average power per group remains constant.

26. Method in accordance with one of the claims 19 to 25, characterized in that
a network element, at which all groups of channels are terminated and which receives a data packet in the uplink direction UL with a counter (COUNT) with a value "2", transmits a data packet with a counter (COUNT) with a value of "0" and deactivates markings at the preceding network element.

27. Method in accordance with one of the claims 19 to 26, characterized in that
a network element which is not the first element of a network section - at which no group of channels will be looped through - and which receives a data packet with a counter (COUNT) with the value "0" in a forwards or backwards direction, passes the packet on without change to the preceding network element.

28. Method in accordance with one of the claims 19 to 27, characterized in that
the value of the counter (COUNT) increases by "1" step-by-step from one pre-emphasis-step to another pre-emphasis-step at the network element at the start of the network section until the receipt of a data packet with a value "1" of the counter (COUNT) signals the completion of the pre-emphasis for this network section.

29. Method in accordance with one of the claims 19 to 28, characterized in that
a network element, at which all groups of channels are terminated preferably at the end of the network section LWL concerned and which receives a data packet with a counter (COUNT) with the value "0" in the uplink direction UL,

initiates one or more pre-emphasis-steps for the subsequent network section (LWL').